EYE ON THE SKY

National Weather Service
Louisville, Kentucky

Summer 2003
Volume 4, Issue 2

A Newsletter for Emergency Managers, Core Storm Spotters, Media, and Public Officials in Central Kentucky and South-Central Indiana

Comments and suggestions are always welcome. Your feedback is very important to us!

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Message From the Top

Welcome to the summer edition of *Eye on the Sky*. This newsletter follows a period of very active weather across the Ohio Valley this past spring. In the first two weeks of May, NWS Louisville issued over 200 warnings, including 14 tornado warnings, 189 severe thunderstorm warnings, and 14 flash flood warnings. Nationally, many severe storms and tornadoes raked across the central part of the United States. In particular, numerous powerful supercell thunderstorms produced several strong and violent tornadoes across the Plains states on May 4, including near Kansas City, Missouri.

The most significant event in central Kentucky occurred during the early morning of Mothers' Day, May 11. In addition to strong straight-line winds, tornadoes were confirmed in Rineyville (Hardin County), Munfordville (Hart County), and near Harrodsburg (Mercer County). These storms resulted in 15 injures, 1 fatality, and a tremendous amount of damage. At the National Weather Service, our hearts go out to those who sustained loses in the severe weather.

When severe weather strikes overnight when most people are asleep, they may not hear the warning or see it on television. In the May 11 event, a combination of timely and accurate radar analyses by NWS forecasters along with reports from storm spotters, emergency managers, and law enforcement allowed us to issue warnings on the approaching storms. Many people said they heard the warnings via NOAA Weather Radio, local radio, or through their community sirens and took cover immediately. More information on the May 11 event is available in the Science Corner section of this newsletter.

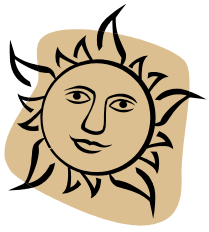
If you or someone you know does not own a NOAA Weather Radio, we recommend the purchase of one. Kentucky and southern Indiana are fortunate enough to have very extensive radio coverage. A small investment can go a long way in saving your life during severe weather, especially during late night and early morning events.

I extend a sincere thank you to all the spotters and emergency service personnel who helped us during the rounds of severe weather in May.

INSIDE THIS ISSUE:

As a reminder to anyone who would like to visit our office in this time of heightened security, it is difficult for us to provide short notice tours. Therefore, please call ahead if you plan on being in the area and would like to stop by. If you have any questions, feel free to call me at (502) 969-8842 X 642. Have an enjoyable summer.

Best Regards,
Kimberly Pye, Meteorologist in Charge



Editors' Note: *The next newsletter will be the Winter 2003/2004 edition, due out in December.*

The Data Bank

by Don Kirkpatrick, Lead Forecaster

Beginning with this newsletter issue, interesting and little known weather facts relevant to the current or upcoming season will be presented to you in a new column called "*The Data Bank*." In this issue, we briefly explore three major weather killers: tornadoes, lightning, and floods.

On May 27, 1896, 400 people were killed and 1200 injured during a massive tornado (likely F4 on today's Fujita Scale) which struck the St. Louis, Missouri area. In less than a half hour, thousands of families were left homeless as block after block of residence property for miles in succession was blown to the ground. Many houses were demolished down to the foundations or left with only fragments of walls standing. Miles of electric wires and thousands of telephone and telegraph poles were knocked to the ground, which increased the threat to life. Tall trees were uprooted, and some hurled a distance of several blocks. Heavy iron fences were twisted, and masonry at the approach of one of the most substantial bridges ever constructed (Eads Bridge) was blown away. Steamboats on the Mississippi River sustained damage as well. The southern part of the city was hit hardest, while the business district and north sides received relatively little damage. The accompanying pictures are examples of damage sustained during the twister. The tornado went down as the greatest weather disaster of that time for St. Louis.



Original pictures from the catastrophic St. Louis tornado damage on May 27, 1896.

On March 18, 1925, a devastating tornado cut a mile wide path for a distance of over 200 miles across parts of Missouri, Illinois, and Indiana. That day changed the lives of thousands of people and made meteorological history as the longest-lived tornado on record. The infamous tri-state tornado killed an estimated 695 persons and left over 2000 injured. It totally obliterated 4 towns and killed 234 people in Murphysboro, Illinois alone.

A single lightning stroke may involve an electrical current as great as 100,000 amperes. This is enough energy to light a city of 200,000 people for one minute. Animals and humans can easily be struck if proper precautions are not taken. On average, the yearly lightning death toll is nearly 100 in the United States, most from cardiac arrest resulting from the strike. Many victims are struck in open places, near isolated tall trees, riding on farm equipment, playing golf, or while on a boat or in water. Most live to tell about it, as did golfer Lee Trevino, but injuries can be significant and even life-long.

When caught in an electrical storm, the best protection is to seek shelter inside an enclosed building. Hard-topped all-metal automobiles also provides protection. In the open, avoid elevated places and isolated trees. If you stand upright, you may act as a lightning rod. Instead, crouch down and keep your head as low as possible, but do not lie down. Minimize contact with the ground since lightning channels usually emanate outward through the ground from the point of a lightning strike. Much more information on lightning is available on our website at *www.crh.noaa.gov/lmk/soo/presentations/Lightning_WFO_LMK.htm* or */Lightning_WFO_LMK.pdf*.

The best protection from cloud-to-ground lightning is to seek shelter immediately inside an enclosed building.

Lightning can do some interesting things. In April 1932, a lightning bolt killed 52 geese that were flying in formation over Elgin, Manitoba. These "cooked geese" fell to the ground and were gathered up and distributed to the townspeople for dinner.

In 1993, persistent heavy rains completely destroyed 8000 homes and inundated 56 small river towns during the Great Flood in the Mississippi and Missouri River basins. Property and crop losses totaled more than 10 billion dollars in the worst flood ever in that part of the United States. Forty-five human lives were lost. In addition, the Great Flood took a huge toll on riverside cemeteries. One cemetery in Missouri had more than 700 graves opened. Some caskets were swept away by flood waters and deposited many miles downstream, and some were never found.

Roller Coaster Weather: Precipitation/Temperature Overview Through May 2003

by Mike Callahan, Service Hydrologist, and James Brotherton, Forecaster

In terms of precipitation, the first several months of 2003 were like a roller coaster, up and down, or in this case, dry and wet. January was dry, invoking thoughts of a dawn to a new drought. Most locations in central Kentucky and south-central Indiana received only around an inch of liquid equivalent precipitation (e.g., Lexington received only 0.95 inches liquid), or 2 to 3 inches below normal. However, these thoughts were dashed when abundant precipitation (4 to 6 inches liquid equivalent) fell over most of the mid Ohio Valley in February, or 1 to 2 inches above normal.

March turned out to be dry again, especially in south-central Kentucky, where precipitation totals were less than 2 inches, or 3 inches below normal. The rest of the area received slightly more precipitation, but still below the monthly normal by about 2 inches. However, April showers brought another wet month and wiped out any chance of a drought this spring. Rainfall totals in April ranged from 4 to 6 inches, or 1 to 2 inches above normal. Amounts were slightly less across the Bluegrass, where near normal precipitation fell.

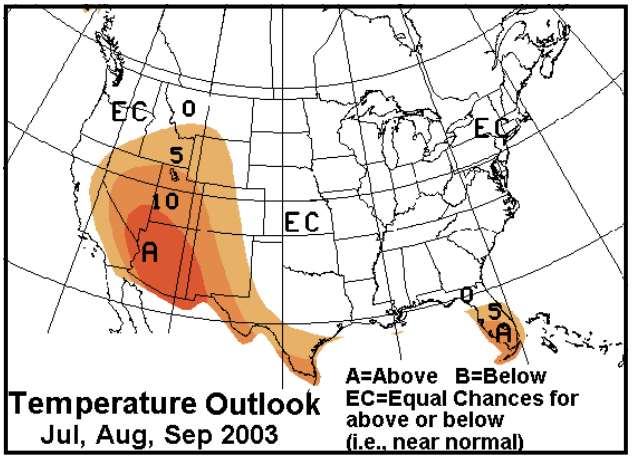
The soaking continued into May, when rainfall totaled around 5 inches, or near normal, in south-central Kentucky and over 8 inches, or 3.5 inches above normal, across the Bluegrass. Specifically, Bowling Green reported 5.01 inches of rain in May, Louisville received 7.66 inches, and Lexington reported 8.35 inches. In fact, the rainfall in Lexington made May the seventh wettest on record. At the end of May, stream levels were above normal across our area and soils were relatively wet. Of course, a wet spring does not guarantee that a dry summer and renewed drought conditions cannot follow. The outlook for this summer calls for near normal temperatures and precipitation, so with luck, drought conditions will be held to a minimum.

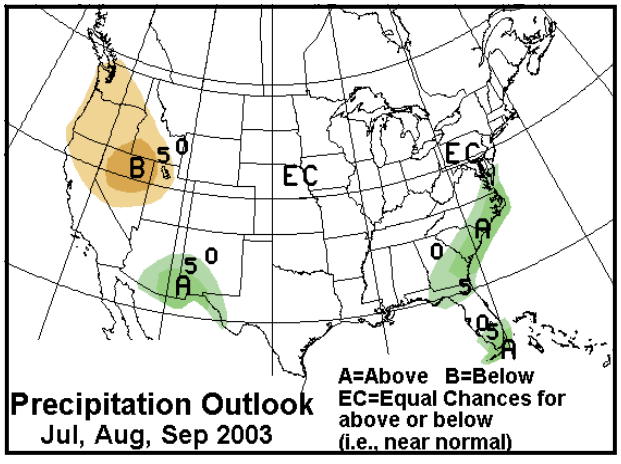
Temperatures this past spring also went up and down frequently, similar to a roller coaster. Overall, March and April were warmer than normal, averaging 0.8 to 1.4 degrees above normal in Louisville, 2.1 to 2.5 above in Lexington, and 2.5 to 3.7 above in Bowling Green. However, due to the heavy rains in May, temperatures were notably cooler across south-central Indiana and central Kentucky. Complaints were made in grocery store checkout lines during May concerning the absence of spring-time sunshine and warmth. For example, May temperatures in Louisville averaged 1.3 degrees below normal, while those at Lexington and Bowling Green averaged 0.2 and 0.4 below normal, respectively. A pronounced pattern of low pressure over the eastern states during May contributed to the cooler and wetter conditions, as did an observed transition away from El Niño conditions in the tropical Pacific Ocean. The hurricane season article in this newsletter provides more information on El Niño and other contributors to the climate outlook.

Mark Trail image courtesy of North America Syndicate, Inc., World Rights Reserved

Did you know?

NOAA Weather Radio is available on the our website via live streaming audio at: www.crh.noaa.gov/lmk/nwr.htm





The outlook for Summer 2003 (July through September) from the Climate Prediction Center indicates near-normal temperatures (left image) and precipitation (right image) for Kentucky, Indiana, and surrounding locations.

Float Your Boat in Safety This Summer!

by Tony Sturey, Lead Forecaster

As summer begins, many folks in central Kentucky and south-central Indiana enjoy recreational boating on area lakes and rivers as a leisure activity. Others may opt for boating ventures in the Gulf of Mexico, Atlantic Ocean, or even in Canada. Boaters in our region are only a small segment of the nearly 70 million people in the United States who enjoy recreational boating each year.

Before you begin your boating activities this summer, take time to review important safety issues or enroll in a boating safety course. The United States Coast Guard (USCG) states, *"Each year hundreds of lives are lost, thousands are injured, and millions of dollars of property damage occurs because of preventable recreational boating accidents on U.S. waterways. Too often pleasure outings turn tragic."* As a boat operator, you can make a difference by understanding various boating regulations, safety issues, and any equipment recalls.

For weather safety purposes in the United States, the National Weather Service provides a routine seven day forecast, plus a "weather sensitive product" known as the Hazardous Weather Outlook (HWO). The HWO is issued daily, and includes information concerning thunderstorm potential, and notable wind, fog, heat, and cold weather phenomena. Meanwhile, near coastal locations and the Great Lakes, specific marine forecasts are prepared by the NWS. As a result, while enjoying our nation's waterways this summer, the NOAA Weather Radio, which is a direct broadcast from the NWS, is your best source to access timely and updated weather information. Don't get caught short, have a NOAA Weather Radio in your water craft, and be alert for changing weather conditions.

Finally, the USCG's website at *www.uscgboating.org* is an excellent resource tool for exploring various boating issues, including federal requirements, consumer advisories, U.S. aids to navigation, boating safety courses, the real dangers of drug and alcohol use on the water, and information concerning the global maritime distress safety system (GMDSS).

Have a safe and fun summer boating season!

Climatological Calendar

Observed Temperatures and Precipitation: Spring 2003

Location	Month	Average Temperature	Departure From Normal	Total Precipitation	Departure From Normal	Highest Temp (Date)	Lowest Temp (Date)
Louisville	Mar	47.7	+0.8	2.25	-2.16	74 (25th/28th)	18 (10th)
	Apr	57.8	+1.4	6.06	+2.15	83 (15th/30th)	33 (6th)
	May	64.5	-1.3	7.66	+2.78	85 (10th)	43 (4th)
Lexington	Mar	47.7	+2.1	2.44	-1.97	74 (28th)	18 (10th)
	Apr	57.2	+2.6	4.10	+0.43	80 (15th)	31 (6th/23rd)
	May	63.6	-0.2	8.35	+3.57	83 (10th)	43 (4th)
Bowling Green	Mar	50.3	+2.5	1.64	-3.33	79 (25th)	22 (4th/10th)
	Apr	60.5	+3.7	5.68	+1.69	84 (15th)	35 (9th)
	May	65.4	-0.4	5.01	-0.35	88 (10th)	44 (4th)

Normal High/Low Temperatures

Location	Jul 1	Aug 1	Sep 1	Oct 1
Louisville	86/69	87/70	83/65	74/55
Lexington	85/65	86/67	82/62	73/52
Bowling Green	88/67	89/68	85/63	76/52

Record Monthly High/Low Temperatures

Jul	Aug	Sep	Oct
107 (1936) 49 (1947)	105 (1918) 45 (1946)	104 (1954) 33 (1949)	92 (1959) 23 (1952)
108 (1936) 47 (1972)	105 (1936) 42 (1965)	103 (1954) 32 (1899)	93 (1941) 20 (1976)
113 (1930) 46 (1947)	110 (1930) 42 (1946)	105 (1925) 26 (1888)	94 (1930) 17 (1887)

The Science Corner

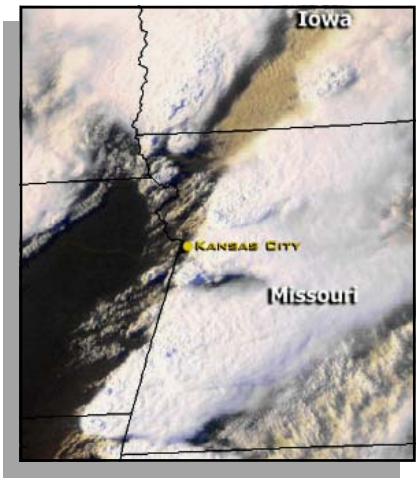
by Ted Funk
Science and Operations Officer

Severe Storms and Tornadoes Inundate Central United States in May 2003

An extremely active period of severe thunderstorms and tornadoes brought devastating results to portions of the central United States during the first two weeks of May. Several episodes of severe weather resulted in countless reports of straight-line wind damage, large hail, and tornadoes over the Plains states eastward to the Ohio and Tennessee Valleys. During the period May 4-10, approximately 395 tornadoes occurred (in 19 states), including several violent tornadoes rated as F4 on the Fujita Scale. NWS offices issued 4867 warnings during this period, including 1090 for tornadoes and 683 for flash floods.

A particularly damaging and deadly episode occurred on May 4, in which over 40 people were killed. On this day, very unstable air and strong, deep-layered atmospheric wind shear resulted in development of giant supercell storms and large tornadoes in up to eight states. Residents of eastern Kansas, western and northern Missouri, and parts of Arkansas, Nebraska, Tennessee, South Dakota, Oklahoma, and Mississippi scrambled for shelter from tornadoes, strong winds, and very large hail.

The first tornado of the day occurred in the early afternoon in south-central Nebraska, with a second tornado an hour later in a nearby county. The outbreak turned deadly when a separate tornado touched down around 4 pm in Leaven-worth County in eastern Kansas. This tornado remained on the ground for one-and-one-half hours, plowing across the northwest through northeast suburbs of Kansas City, Missouri. The tornado, which reached up to 500 yards across, was blamed for one death in Kansas City, Kansas. Over 21 others were injured along its path. The tornado also forced the temporary closure of Kansas City International Airport, where officials evacuated the control tower and guided travelers to tunnels for about 30 minutes.



Visible satellite image on May 4. The tops of large tornadic super-cell thunderstorms were evident over Iowa, Missouri, and extreme northeast Oklahoma. The tex-tured white cloud tops revealed the most active part of the storms. A clear (dark) slot behind the storms was evident in eastern Kansas at this time.

The death and injury toll could have been much higher given the magnitude of the tornado in an urban area. The Kansas City NWS office, emergency management, media, and public were credited with keeping fatalities and injuries to a minimum. "Sunday (May 4) in the Kansas City metropolitan area provided an example of how lives are saved when everyone pays heed to a tornado warning and takes action," said Mike Looney, a Division Chief at the NWS's Central Region Headquarters in Kansas City. "Our forecasters com-municated early with emergency management and the media to give them advance notice that severe weather was on the way. Local media, especially the TV weather forecast crews, did an excellent job of providing critical and timely information to the public. Residents paid attention and did what they needed to do to keep safe. To have such a large tornado on the ground for more than an hour in an urban area with so few injuries is a credit to everyone."

House damage in a subdivision near Kan-sas City on May 4. Significant tornado damage occurred in northern parts of the metro area.

Another tornado cut a large path through southeast Kansas, killing 6 people. Authorities reported that over 10 fatalities occurred in the town of Pierce City, Missouri (35 miles southwest of Springfield), which was demolished. Many of the deaths occurred when a large tornado leveled a National Guard armory that people had sought shelter in. Numerous counties in Kansas and Missouri sustained extensive property damage; some were declared disaster areas. In western Tennessee, officials reported significant property damage and the loss of at least 11 people when a long-lived tornado moved through Madison County and the city of Jackson. Another tornado caused several injuries and heavy damage in Dyersburg, Tennessee. Tornadoes also were reported in parts of Arkansas, northeast Oklahoma, and northwest Mississippi.

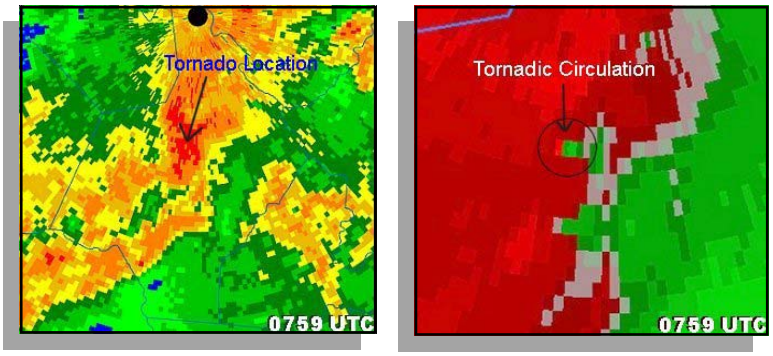
On May 6, tornadoes did extensive damage in De Soto, Missouri and in portions of southern Illinois and western Kentucky. Flooding was reported across parts of the southeastern United States. On May 7, supercells moved across

Severe Storms and Tornadoes Inundate Central United States in May 2003 (cont.)

northern Mississippi to western Georgia, with wind damage in Atlanta. On May 8, tornadoes injured over 100 people and destroyed 300 homes in Moore, Oklahoma. Additional tornadoes occurred in northern and eastern Kansas with Lawrence especially hard hit. Yet another tornado was on the ground for nearly 5 hours the night of May 9 near Oklahoma City, damaging a Xerox plant and several schools. Five injuries also were reported. In all, portions of Missouri, Kansas, Tennessee, and Oklahoma were declared Presidential disaster areas.

Several rounds of severe weather also plagued Kentucky during May, as supercell, squall line, and bow echo type thunderstorms brought wind damage, large hail, and several tornadoes. During May, NWS Louisville alone issued over 200 severe weather warnings, including 14 tornado warnings and a number of flash flood warnings. The most significant event occurred during the early morning of Mothers' Day, May 11, when severe storms spawned several tornadoes in central Kentucky resulting in 1 fatality and a number of injuries.

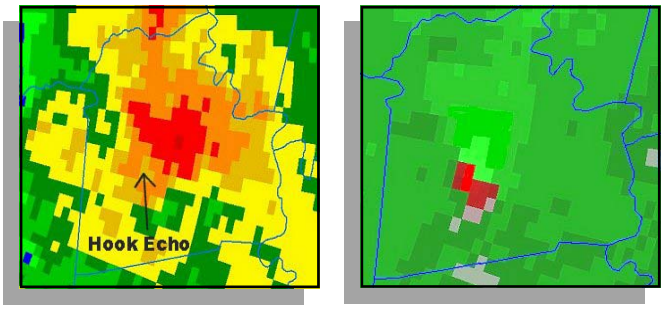
Damage to a tree (debarked) in Rineyville, KY on May 11. The tornado caused a 2-3 foot long steel beam to become a projectile which was injected into the tree.



Reflectivity (left) and storm-relative velocity (right) images at 0759 UTC (359 am edt) May 11 over Hardin County, KY from the NWS Louisville WSR-88D Doppler radar (located at the black circle at the top of the reflectivity image). In reflectivity, the strongest storms and heaviest rain were occurring in the area of red color. The tornado in Rineyville was embedded within heavy rainfall. The velocity image showed the tornadic circulation, i.e., couplet within circle of green pixels of inbound winds directed toward the radar (located just north of image) and red outbound winds on left directed away from the radar).

In Hardin County, a line of severe storms spawned an F1-F2 tornado embedded within a swath of significant straight-line wind damage. The tornado formed just southwest of Rineyville, then skipped northeast around 45 mph through the town where most of the damage was noted. Estimated maximum winds were up to 150 mph with a tornado width near 75 yards at maximum intensity.

Storm damage to a house in Mercer County, KY on May 11. Debris was wrapped around the tree.

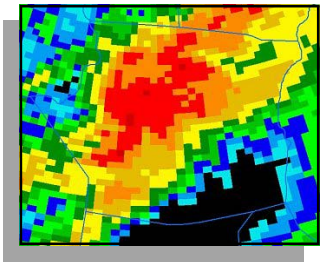


WSR-88D Doppler radar reflectivity (left) and storm-relative velocity (right) images over Mercer County, KY showed a supercell storm with a hook echo on the southwest side, which was coincident with a strong mesocyclone (rotating updraft; red/green couplet) and associated with an F2 tornado.

Over Mercer County, a supercell produced F2 damage and maximum estimated winds of 155 mph. The tornado formed 6 miles west of Harrodsburg then strengthened as it moved to near Bohan Road and U.S. Route 127. The estimated path length was 7 miles, with maximum path width of 200-300 yards. Unfortunately, the storm caused 1 fatality as a mobile home was swept into a nearby river. Eight injuries also were reported.

Finally, another storm downed trees and power lines in and around Munfordville in Hart County, just east of Interstate 65. Embedded within the wind damage were 2 brief tornado touchdowns that produced F1 type damage. Additional images from the May 11, 2003 event in central Kentucky are available at *www.crh.noaa.gov/lmk/soo/88dimg/51103_evt.htm*.

Summer also can bring severe weather to our area, but organized, significant severe events decrease in number as weather systems become weaker. Nevertheless, severe storms and tornadoes can occur in any month of the year, so be sure to continue monitoring weather conditions and forecasts this summer.



Reflectivity image of the severe storm that produced wind damage and an F1 tornado over Hart County, KY on May 11.

Welcome to Another Hurricane Season!

by James Brotherton, Forecaster

To some people, it may seem strange to read an article about the new hurricane season in a newsletter designed for central Kentucky and south-central Indiana. However, to others it may be instantly understandable.

Although a rare early spring tropical storm formed east of Bermuda in April, the official Atlantic, Gulf of Mexico, and Caribbean Sea hurricane season did not begin until June 1. The direct impact of hurricane and tropical storm landfalls is felt along the coast and only tens of miles inland from the coast in the low lying coastal plains of the southern and eastern United States. However, indirect effects can have a large impact on locations far from the coast, including in our area.

This was obvious late last September when the remnants of Tropical Storm Isidore brought heavy rainfall amounts of 7 to 10 inches to parts of central Kentucky. Several occurrences of flash flooding resulted from the storm.

In early October, the remnants of Hurricane Lili brought a narrow swath of one inch or more rainfall across central and western Kentucky and as far north as Chicago, Illinois. Rainfall amounts were modest, since the storm was moving significantly faster compared to the earlier remnants of Isidore. However, wind gusts associated with the remnant circulation of Lili were in the 40 to 50 mph range across portions of central and western Kentucky on October 4.

Dr. William Gray of Colorado State University has released an updated prediction for the 2003 hurricane season. The report, released May 30, indicates that an above-normal level of activity is likely this season. One of the primary reasons for this prediction is that data hints at a return to weak La Niña (cold episode) conditions.

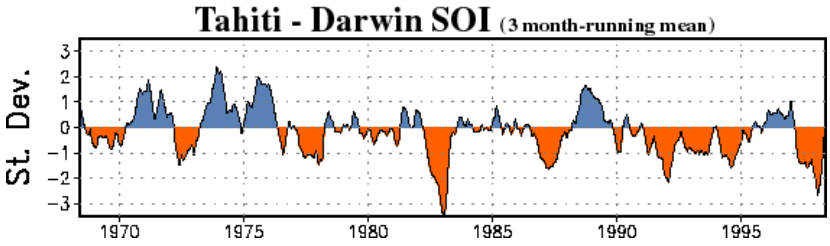
The latest El Niño forecast from the NWS's Climate Prediction Center indicates that a La Niña episode is already underway. The tell tale signs of La Niña should begin to "surface" within a couple more months. One of the main characteristics of a La Niña is cooler than normal sea surface temperature anomalies over the tropical Pacific Ocean. Another indicator of this phenomenon is abnormally low air pressure over the western tropical Pacific and abnormally high pressure over the eastern tropical Pacific. The island of Tahiti traditionally is used as a baseline for air pressure in the eastern Pacific, while Darwin, Australia traditionally is used as a baseline for the western Pacific. The image below gives an example of this effect.

The following table shows Dr. Gray's latest hurricane season forecast and the seasonal averages:

	May 2003 Forecast	Seasonal Averages
Named Storms:	14	9.6
Hurricanes:	8	5.9
Intense (Cat. 3 or higher)	3	2.3

In addition, according to Dr. Gray's forecast, there also is a 69 percent probability of a major landfalling hurricane on the United States coastline, compared to a statistical average of 52 percent.

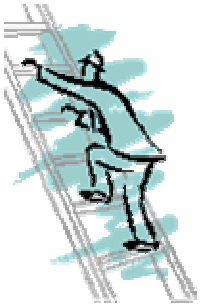
For more information on the current hurricane season, which runs until November 30, visit the National Hurricane Center's website at *www.nhc.noaa.gov*. Late August through mid October typically is the peak period of the hurricane season. Thus, if you plan any travel to the Gulf of Mexico or Atlantic Ocean late this summer and fall, be sure to keep abreast of the latest weather information through a local media outlet, portable NOAA Weather Radio, or the internet at *weather.gov*.



This chart shows the climatic variability (standard deviation) of the El Niño (warm) cycle through the air pressure differences between Tahiti and Darwin. This is commonly referred to as the Southern Oscillation Index (SOI). When the index is negative, it is indicative of a warm episode. *Image courtesy NOAA/Climate Prediction Center.*

Staff Farewells and New Additions

Russ Conger, longtime NWS Louisville lead forecaster, retired on April 19, 2003 after nearly 32 years of federal service. Uniquely enough, Russ began his NWS career in Louisville as a meteorologist intern in June 1971. Russ was then promoted to a forecaster at Topeka, Kansas in 1974. After a short time in Topeka, he returned to the Louisville office as a lead forecaster in 1977, the position he would hold for more than 25 years. Russ saw the NWS evolve from teletypes, paper tape, and tube-type radars to today's nearly instantaneous communications, Doppler radars, and satellite displays. Among the many historical weather events Russ worked was one of the worst tornado outbreaks in U.S. history. On the evening on April 3, 1974, Russ and his workmates issued a tornado warning for the residents of Louisville, 37 minutes before a tornado hit. The Louisville tornado of April 3, 1974 is memorable to residents since it demolished over 900 homes in the city. The staff of NWS Louisville wishes Russ happiness and relaxation in his retirement. Russ's lead forecaster position was filled through an on-station promotion of Chris Smallcomb. We congratulate both Russ and Chris on their career milestones.



Another farewell for the Louisville weather office came in May when Van Dewald, Louisville forecaster for 8 years, was promoted to lead forecaster at the office in Omaha, Nebraska. Van is well missed by the Louisville office due to his good attitude, willingness to help out in all areas of office operations, and wealth of computer knowledge. Van also was one of the original editors of this newsletter, *Eye on the Sky.*

Two new forecasters have been hired to replace the positions that Chris and Van left behind. First to arrive in Louisville in early June was Mark Jarvis. Previously, Mark was a forecaster at the Jackson, Kentucky office where he worked for nearly two years. Mark is a Kentucky native, having grown up in the Elizabethtown area. Mark previously worked at NWS Louisville as a summer student volunteer in Summer 1995. Mark earned his Bachelor's degree in meteorology in 1998 and his Master's in meteorology in 2001 from Florida State University. Next to arrive in early July will be Ben Schott, coming from the Morristown/Knoxville, Tennessee weather office. Ben is a native of Anderson, Indiana near Indianapolis. He spent two years studying Atmospheric Science at Purdue University before joining the Navy. Ben served the Navy as both a weather observer and forecaster on the USS Abraham Lincoln. At the end of his enlistment, he re-entered the academic world at the University of Washington and completed his Bachelor's degree in Atmospheric Science. While at the University of Washington, Ben worked at as a weather producer at a Seattle TV station, developing the daily forecast for the evening news.

Please welcome Mark and Ben to their new home at the National Weather Service in Louisville!

Astronomical Calendar

Sunrise and Sunset

	Louisville		Lexington		Bowling Green		
Date	**Sunrise**	**Sunset**	**Sunrise**	**Sunset**	**Sunrise**	**Sunset**	Times are given in edt (Eastern Daylight Time) and cdt (Central Daylight Time), as appropriate.
Jul 1	6:23 am edt	9:10 pm edt	6:19 am edt	9:05 pm edt	5:30 am cdt	8:09 pm cdt	
Aug 1	6:45 am edt	8:53 pm edt	6:41 am edt	8:48 pm edt	5:51 am cdt	7:53 pm cdt	
Sep 1	7:12 am edt	8:13 pm edt	7:07 am edt	8:08 pm edt	6:16 am cdt	7:15 pm cdt	

Moon Phases

New Moon	First Quarter	Full Moon	Last Quarter
Jun 29	Jun 7	Jun 14	Jun 21
Jul 29	Jul 7	Jul 13	Jul 21
Aug 27	Aug 5	Aug 12	Aug 20
Sep 26	Sep 3	Sep 10	Sep 18

Summer Solstice (Start of Summer): June 22 at 8:14 pm edt (7:14 pm cdt)